Efficacy of errorless learning in the acquisition of a new procedural skill in Alzheimer's disease

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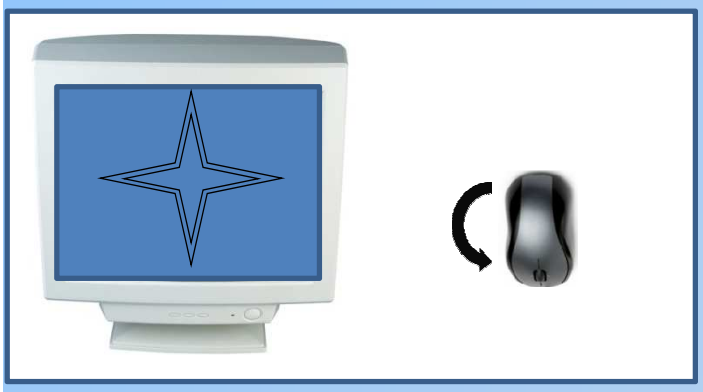
Introduction

- Motor-learning capacities are known to be relatively preserved in Alzheimer's disease patients (AD), which is crucial in the context of the patient's autonomy (Willingham et al., 1997).
- It is important to determine which are the most appropriate techniques for such learning. In AD, implicit rehabilitation techniques would be more effective to train new skills than explicit or declarative learning methods (van Halteren-van Tilborg, 2007).
- According to Maxwell et al. (2001), error reduction during the acquisition phase would enhance the involvement of implicit processing in procedural learning.
- A few studies on cognitive training programs including errorless learning showed positive results for learning activities of daily living in AD (Zanetti et al., 2001; Lekeu et al., 2002; Thivierge et al., 2008).
- Our aim was to test the effectiveness of errorless learning for the acquisition of new perceptual-motor skills in AD patients.
- We also wanted to test whether the advantage of errorless learning would be greater among subjects with deficits in working memory and executive functions.

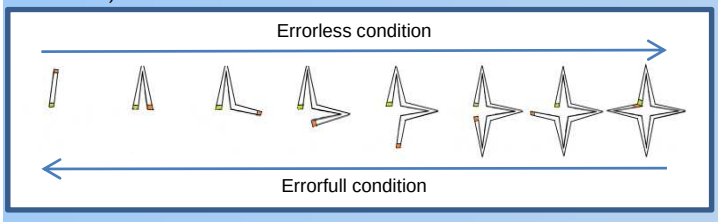
Method

Participants :
24 patients with AD (Age = 75.5, SD = 6.32, Mattis score = 122.92 ± 8.56) and 24 healthy older adults (Age = 75.7, SD = 5.82, Mattis score = 138.83 ± 4.99) matched for age, sex and years of schooling.

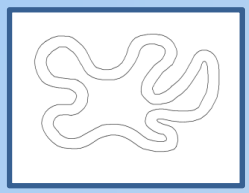
Learning phase :
Subjects had to follow with a reversed mouse the contour of a form (a star) displayed on a computer screen.



For half the subjects a small part of the form is first administered, and then the missing elements are added little by little (**Errorless condition**). The other subjects started the learning session by completing the entire star (**Errorfull condition**).



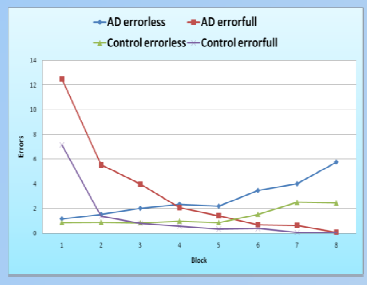
Post test : All the subjects had to complete a novel form.



Results

Learning phase

There is a significant effect of Learning condition on the numbers of errors produced in the first and the last learning blocks (F=4.29; p=.04): More errors are generated in the errorfull condition than in the errorless condition.



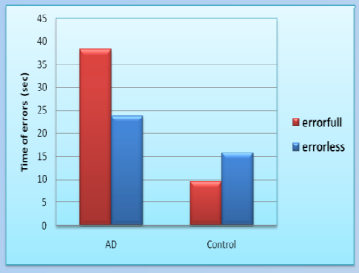
Post test

Time of error analysis (time spent when the cursor was outside of the form):

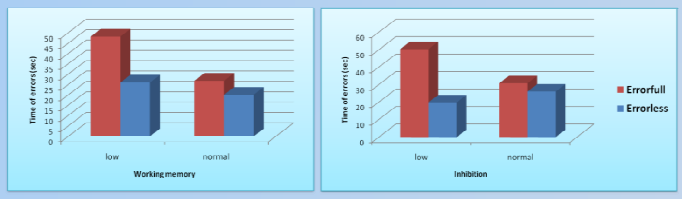
Significant difference between AD patients and control subjects: F=11,02, p=.002.

Interaction Group*Condition: F=3,58, p=.06.

Significant difference between AD in Errorless condition and AD in Errorfull condition: F=4,45, p=.04.



Time of error analysis in AD patients in function of their working memory and their motor inhibition capacities:



We observe an advantage for the errorless condition only for AD patients with low scores in working memory (F=5,01, p=.04) and motor inhibition (F=4,02, p=.06).

Discussion

1. **In the learning phase, we observe a lower error rate in the errorless condition.**
2. **In the post-test, AD patients show a lower performance than the control subjects.**
3. **Results show an advantage for the errorless condition in the AD group, whereas the performance of the healthy participants did not differ between the two conditions.**
4. **We observe an advantage of learning without errors only in AD patients whose capacity of working memory and inhibition are deficient.**

In conclusion, when we gradually increase the difficulty of the task, it is possible to reduce the number of errors produced during learning. For the acquisition of a new procedural skill, this technique shows a beneficial effect in AD patients, especially in those with impaired working memory and inhibitory abilities (which serve as error correction mechanisms in healthy subjects).

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